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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|------------------------|---|------------------------------|
| Application of: |) | FILTER FOR REMOVING CONTAMI- |
| |) | NANTS FROM WATER AND METHOD |
| TOSHIO MATSUMURA ET AL |) | OF FORMING THE FILTER |
| |) | |
| Ser. No.: 09/594,324 |) | Examiner I. Cintins |
| |) | |
| Filed: June 15, 2000 |) | Art Unit 1724 |

RESPONSE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313
Sir:

Claims 1, 3-11 and 14-31 are currently pending in the application. Claims 25-31 have been withdrawn from consideration.

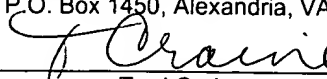
Claims 1, 5, 21, 22 and 24 stand rejected under 35 USC §103 as obvious over U.S. Patent No. 5,882,517, to Chen et al (Chen), in view of U.S. Patent No. 4,753,728, to Vanderbilt et al (VanderBilt). Claims 1, 3-11 and 14-24 stand rejected under 35 USC §103 as obvious over Japanese Unexamined Patent Application Publication No. 10-85729 in view of Chen and Vanderbilt.

Reconsideration of the rejection of claims 1, 3-11 and 14-24 is requested.

As previously noted, the excellent results achieved through the claimed structure are attributable to a combination of the nature of both the particulate material and the binder. For a specific binder selection, flow characteristics will vary depending upon the

37 CFR 1.8
CERTIFICATE OF MAILING

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Terri Craine

nature of the particulate material. The combination of elements in the specific structure, as claimed, accounts for the unexpectedly good operating characteristics.

It is respectfully submitted that the prior art cited by the Examiner does not teach or suggest the filter structure in claim 1. Applicant previously submitted test results to confirm the unexpected results achieved through the claimed structure. It is the applicant's interpretation of the Examiner's rejection that the test results previously submitted do not confirm the unexpectedly good results of the filter with components over the ranges stated in claim 1. The following actual test results are being submitted to evidence the unexpectedly good performance of the filter in the ranges recited for the components in claim 1. It is further stated that these ranges are not taught or suggested by any of the prior art of record, taken either alone or in combination.

1. The significance of the range of ratios of a) particulate active carbon passed through a mesh of from 60 to 100 and b) particulate active carbon passed through a mesh of 100, as from 1:1 to 4:1, was determined as follows.

Example 1

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). This whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set

density of 0.55 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the flow rate at initial treatment and the capability of treating each of residual chlorine and turbidity. These items were determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

Comparative Example 1

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 5 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set density of 0.55 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the flow rate at initial treatment and the capability of treating each of residual chlorine and turbidity. These items were determined in accordance with

the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

Comparative Example 2

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 1 to 2. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set density of 0.55 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the flow rate at initial treatment and the capability of treating each of residual chlorine and turbidity. These items were determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

The relative performance of the Examples is set out in the following Table 1.

Table 1

| Evaluation Item Test Conditions | Flow Rate at Initial Treatment [L/min] (Dynamic Water Pressure 0.1MPa) | Capability of Removing Residual Chlorine [L] (Treating Flow Rate 2.0L/min) | Capability of Removing Turbidity [L] (Dynamic Water Pressure 0.1MPa) |
|------------------------------------|---|---|---|
| Example 1 | 3.6 ~ 4.0 | 4000 | 1800 |
| Comparative Example 1 | 4.2 ~ 4.5 | 1500 | 900 |
| Comparative Example 2 | 1.1 ~ 1.5 | --- | 200 |

2. The significance of the range of 10-25% by weight of the high-molecular porous polymer was determined as follows:

Example 1

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set density of 0.55 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the capability of treating each of residual chlorine and the size of outer diameter. The capability of treating each of residual chlorine was

determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

Comparative Example 3

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 8% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression. Active carbon was not formed with the polymer.

Comparative Example 4

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 30% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in dinner diameter ϕ x 92 L, was formed with an after-set density of 0.55 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the capability of treating each of residual chlorine and

the size of outer diameter. The capability of treating each of residual chlorine was determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

The relative performance of the Examples is set out in the following Table 2.

Table 2

| | Capability of Removing Residual Chlorine [L] (Treating Flow Rate 2.0L/min) | Outer diameter [mm] |
|-----------------------|--|---------------------|
| EXAMPLE 1 | 4000 | φ45 |
| COMPARATIVE EXAMPLE 4 | 2500 | φ43 |

3. The significance of the melt index range as 1.1 to 2.3g/10min was determined as follows.

[Test 1] Lower Range

Example 2

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 10% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). This whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter φ x 11 in inner diameter φ x 92 L, was formed with an after-set density of 0.6 g/cm³.

Comparison Example 5

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 10% by weight of a high-molecular porous polymer of 1.0 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression. Active carbon was not formed with the polymer.

[Test 2] Higher Range

Example 3

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in dinner diameter ϕ x 92 L, was formed with an after-set density of 0.6 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the flow rate at initial treatment. These items were

determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

Comparative Example 6

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 2.6 g/10 min (ASTM D1238, 190°C, 15 kg Load) (HI-ZEX 7000PP, product of Mitsui Chemicals, Inc.). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set density of 0.6 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the flow rate at initial treatment. These items were determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

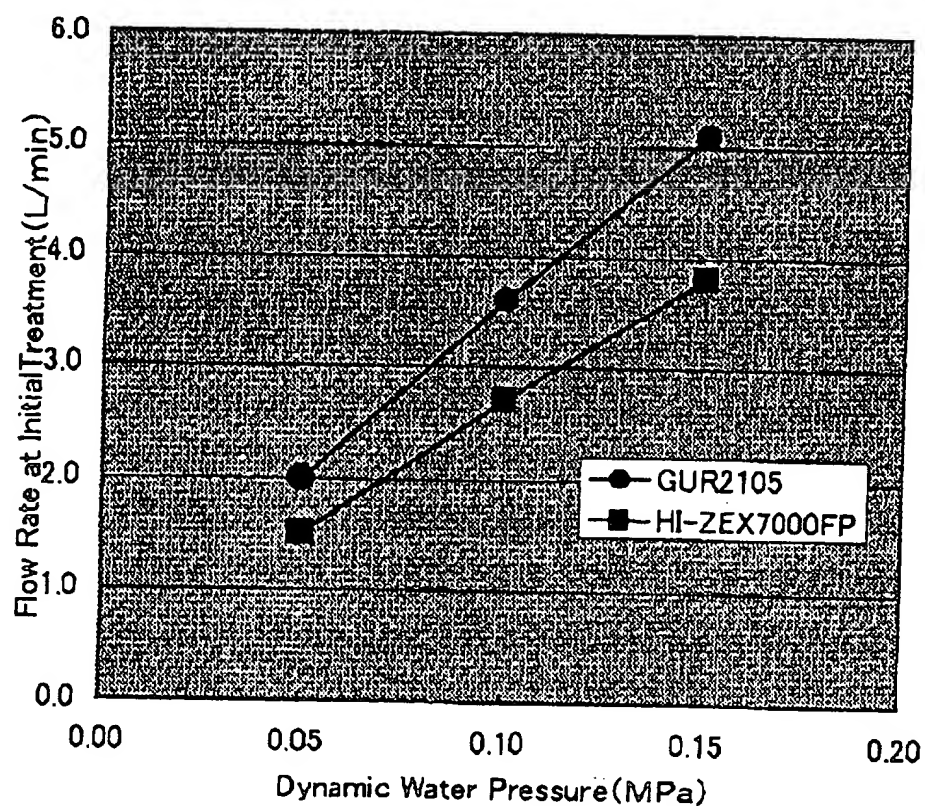
The relative performance of the Examples are set out in the following Table 3 and Fig. 1.



Table 3

| | Melt Index [g/10 min] (ASTM D1238, 190°C, 15kg Load) | Flow Rate at Initial Treatment [L/min] (Dynamic Water Pressure 0.1 MPa) |
|-----------------------|--|---|
| EXAMPLE 3 | 1.5 | 3.6 |
| COMPARATIVE EXAMPLE 6 | 2.6 | 2.7 |

Fig.1



4. The significance of the range of density 0.5 to 0.65g/cm³ was determined as follows.

Example 1

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set density of 0.55 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the flow rate at initial treatment. The flow rate at initial treatment was determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

Comparative Example 7

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer

diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set density of 0.47 g/cm³. The strength of active carbon block was limited.

Comparative Example 8

A particulate active carbon passed through a mesh of from 60-100 and a particulate active carbon passed through a mesh of 100 were mixed in a ratio of 2 to 1. To this mixture was added 15% by weight of a high-molecular porous polymer of 1.5 g/10 min (ASTM D1238, 190°C, 15 kg Load) (GUR 2105, product of Ticona GmbH). The whole mixture was heated in a mold at 200°C for one hour and then cooled, followed by adjustment of the extent of compression, whereby an active carbon block dimensioned to be 45 in outer diameter ϕ x 11 in inner diameter ϕ x 92 L, was formed with an after-set density of 0.68 g/cm³. A nonwoven fabric was wound around an outer peripheral surface of the block, followed by attachment of caps to top and bottom portions of the block. The caps were made of polyethylene resin, at least one of which was provided with an opening. A filter for use in a water treatment apparatus was thus obtained. Evaluation was made of the resultant filter with regard to the flow rate at initial treatment. The flow rate at initial treatment was determined in accordance with the test method of water treatment apparatus for household use (JIS S3201: 1999) or the water treatment apparatus (JWWA S102: 1998).

The relative performance of the Examples are set out in the following Table 4.

Table 4

| | Flow Rate at Initial Treatment [L/min] (Dynamic Water Pressure 0.1MPa) |
|-----------------------|--|
| EXAMPLE 1 | 3.6 ~ 4.0 |
| COMPARATIVE EXAMPLE 8 | 0.9 ~ 1.0 |

As previously noted, the claimed subject matter resulted from extensive testing. Through this testing, it was found that a polymeric binder with a melt index within a particular range, used with other components as set forth in claim 1, permits a high flow rate while sufficiently maintaining the carbon particles in a form with good integrity so that water would flow through and utilize the majority of the volume of the carbon therein without the creation of channels, and while effectively allowing the carbon particles to filter the contaminants from the water supply. Thus, there is a balancing of performance characteristics that would not be optimized to the claimed ranges, based on the prior art, without the use of applicant's disclosure and the benefit of hindsight.

It is respectfully submitted that the claims recite patentably over the cited prior art. Reconsideration of the rejection of claims 1, 3-11 and 14-24 and allowance of the case are requested.

Respectfully submitted,

By 
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